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Review Article

PHYTOCHEMICAL AND PHARMACOLOGICAL PROFILE OF *PUNICA GRANATUM:* AN OVERVIEW

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ABSTRACT
The pomegranate, *Punica granatum* belongs to family lythraceae is an ancient, mystical, unique fruit borne on a small, long-living tree cultivated throughout the Mediterranean region, as far north as the Himalayas, in Southeast Asia, and in California and Arizona in the United States. Phytochemical investigation for current research seems to indicate the most therapeutically beneficial pomegranate constituents are ellagic acid ellagitannins (including punicalagins), punicic acid, flavonoids, anthocyanidins, anthocyanins, and estrogenic flavonols and flavones. Pharmacological activity proved its an antioxidant, an anticarcinogenic, and an anti-inflammatory properties of pomegranate constituents have been published, focusing on treatment and prevention of cancer, cardiovascular disease, diabetes, dental conditions, erectile dysfunction, bacterial infections and antibiotic resistance and ultraviolet radiation-induced skin damage. Other potential applications include infant brain ischemia, male infertility, Alzheimer's disease, arthritis and obesity.
Keyword: *Punica granatum,* Lythraceae, Phytochemical constituents, Pharmacological activity.

INTRODUCTION

Medicinal plants play an important role in the development of potent therapeutic agents. Natural products from plant, animal and minerals have been the basis of the treatment of human disease. Today estimate that about 80 % of people in developing countries still relays on traditional medicine based largely on species of plants and animals for their primary health care. Herbal medicines are currently in demand and their popularity is increasing day by day. About 500 plants with medicinal use are mentioned in ancient literature and around 800 plants have been used in indigenous systems of medicine. India is a vast repository of medicinal plants that are used in traditional medical treatments. In India around 20,000 medicinal plant species have been recorded recently but more than 500 traditional communities use about 800 plant species for curing different diseases. Currently 80% of the world population depends on plant-derived medicine for the first line of primary health care for human alleviation because it has no side effects. Plants are important sources of medicines and presently about 25% of pharmaceutical prescriptions in the United States contain at least one plant-derived ingredient[1] . The attempt is made to present an overview of phytochemical and pharmacological activities of the plant *Punica granatum.*

Punica granatum belongs to family Lythraceae, is a deciduous tree distributed throughout the world. *Punica granatum* generally called as Pomegranate. It known with different names in different languages. *Pomegranate* (English), *Dadam* (Gujarati), *Anar* (Hindi), *Dadima (*Sanskrit), *Daalimbe* (Kannada), *Madulai* (Tamil), *Madalam* (Malayalam) *Daalimb* (Marathi). In older times the fruit considered in old Testament of the Bible, the Jewish Torah, and the Babylonian Talmud as a sacred fruit conferring powers of fertility, abundance, and good luck. It is the symbol and heraldic device of the ancient city of Granada in Spain from which the city gets its name[2].

Ethnobotany[3,4,5,6,7]

Pomegranate is considered an excellent tree for growing in arid zones for its resistance to drought conditions. It is now widely cultivated in Mediterranean, in tropical and subtropical areas. It can be encountered as regular plantations in Cyprus, Egypt, Morocco, Spain, Tunisia and Turkey. A high number of scattered trees on the borders or within other fruit orchards are reported in many Mediterranean countries where the fruit is very popular in local markets. It is cultivated in central Asia and to some extent in the USA (California), Russia, China and Japan for fruit production and is also developed as an ornamental tree in east Asia. Pomegranates (*Punica granatum*) grow on woody plants that more closely resemble shrubs than trees. Mature plants are usually 6 to 12 feet in height and can easily be trained to a tree form or espaliered against a wall or fence. Pomegranate plants are deciduous, have small oval leaves, and are somewhat thorny. They require full sun, tolerate our alkaline soils, summer heat, and winter lows to 10 degrees F. *Punica granatum* adaptable Deep, loamy, well-drained soils are preferred but it has some tolerance to less than ideal drainage and to mild alkaline conditions upto pH 7.5. *Punica granatum* prefer a semi-arid mild-temperate to subtropical climate and are naturally adapted to regions with cool winters and hot summers. *Punica granatum* fruit is approximately 2.5-5" wide. It has red, leathery rind. Each seed is encased in pulp and sectioned of by walls.

Plant

Grow on woody plants that more closely resemble shrubs than trees. Mature plants are usually 6 to 12 feet in height and deciduous, have small oval leaves, and are somewhat thorny.

Leaves

Colour : Dark green.
Size : 3-7 cm long and 2 cm broad.
Shape : Glossy and have a leathery leaves that are narrow and lance-shaped.

Blossoms

Produced in summer where rainfall is minimal during late summer.

Flower

Colour : Bright red with 5 to 8 crumpled petals which persists on the fruit.
Size : 3 cm in diameter.

Fruit

Size : Typically ranges from 2 to 5 inch wide.
Colour : Tough, leathery skin or rind is typically

yellow overlaid with light or deep pink or rich red.

Traditional Uses

Punica granatum has traditionally used as in different countries. In south anatolia, turkey, some people employ the ashes of the fruit peel as protective against skin infection[8]. In Iran whose flowers are used as an astringent, hemostatic, antibacterial, antifungal, antiviral and as remedy for cut wound, bronchitis, diarrhea, digestive problems, men sex power reconstituent, dermal infected wounds and diabetes in Unani medicine (Iranian Traditional Medicine) literature. In chinese medicine these flowers are also used for the treatment of injuries from falls and grey hair of young man[9]. In addition *Punica granatum* is considered as "a pharmacy unto itself" in ayurvedic medicine and is used as an antiparasitic agent[10], a blood tonic[11], and to heal ulcers[12].

Chemical Constituent[5]

Current research seems to indicate the most therapeutically beneficial pomegranate constituents are ellagic acid, ellagitannins (including punicalagins), punicic acid, flavonoids, anthocyanidins, anthocyanins, and estrogenic flavonols and flavones. Commonly found in many plants ellagic acid exhibits powerful anticarcinogenic and antioxidant properties, propelling it to the forefront of *Punica granatum* research. Many commercially available pomegranate extracts are being standardized to contain 40-percent (or more) ellagic acid. however, Lansky, a prominent researcher on the medicinal properties of *Punica granatum*, cautions against focusing on ellagic acid standardization to the exclusion of other therapeutically important *Punica granatum* constituents.

Pharmacological Activity

Anticancer activity[13] In vitro assays utilizing three prostate cancer cell lines (DU-145, LNCaP, and PC-3) demonstrated various pomegranate extracts (juice, seed oil, peel) potently inhibit prostate cancer cell invasiveness and proliferation, cause cell cycle disruption, induce apoptosis, and inhibit tumor growth. These studies also demonstrated combinations of *Punica granatum* extracts from different parts of the fruit were more effective than any single extract. Several animal studies have elucidated pomegranate's potential anticancer mechanisms. Two studies in mice implanted with the prostate cancer PC-3 cell line demonstrated pomegranate fruit extract (PFE; edible parts of the fruit, excluding the peel) inhibits cell growth and induces apoptosis via modulation of proteins regulating apoptosis.

Anti-inflammatory Activity[14] Cold pressed *Punica granatum* seed oil (CPSO) has been shown to inhibit both cyclooxygenase and lipoxygenase enzymes in vitro. Cyclooxygenase, a key enzyme in the conversion of arachidonic acid to prostaglandins (important inflammatory mediators), was inhibited by 37 percent by a CPSO extract. Lipoxygenase, which catalyzes the conversion of arachidonic acid to leukotrienes, also key mediators of inflammation, was inhibited by 75 percent by a CPSO extract. By comparison, an juice extract resulted in a 23.8-percent inhibition of lipoxygenase in vitro[13].

Neuroprotective Activity[13] *Punica granatum* is highly valued for its neuroprotective property in stress-induced neurodegenereation like Alzheimer's disease. The drug triggers the inhibition of AchE causes prolong half-life of acetylcholine which known to be useful in treating cognitive decline, improving memory or related CNS activity.

Reproductive Function[14] *Punica granatum* seed extract has been shown to posses antispermatogenic effect. Force produced in the presence of *Punica granatum* seed extract was abolished by the inhibition of L-type calcium channels or myosin light chain kinase (MLCK). Contractions were not potentiated by *Punica granatum* extract following the inhibition of K channels or inhibition of the sarcoplasmic reticulum calcium ATPase (SERCA).

Antiatherogenic effect[15] *Punica granatum* is shown to be antiatherogenic property by restoring the balance between the prooxidants and antioxidants. The antiatherogenic effect of the drug may be due to its antioxidant, hypolipidaemic, platelet antiaggregation and lipoprotein lipase releasing properties.

Hypoglycemic and antiglycemic effect[13] A pilot study in type 2 diabetic patients with hyperlipidemia observed that concentrated fruit juice decreased cholesterol absorption, increased fecal excretion of cholesterol. *Punica granatum* flower extract (PFLE) improved insulin sensitivity and lowered glucose levels in rats as early as 30 minutes post-glucose loading. *Punica granatum* fruit leafs extract also inhibited alpha glucosidase in vitro, thereby decreasing the conversion of sucrose to glucose. Plant extract demonstrates significant hypoglycemic activity in diabetic rats, via enhanced insulin levels and regeneration of pancreatic beta cells.

CONCLUSION

Now a days herbs are extensively use for the research purpose and it possess more than one chemical entities so it has widely carried out for the research investigation. On the basis of medicinal herb so many herbs has been investigated and however mechanism of action of *Punica granatum* has not identified so far. An article shows strongly present detailed information about the plant and different biological active compounds shows efficacy on the herb. *Punica granatum* is an interesting example of a plant used in traditional medicine for many year and the reported phytochemical and pharmacological studies supports its traditional uses and proved to be useful for clinical studies and development of commercial drugs.

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Table 1: DIFFERENT VERNACULAR NAMES OF *PUNICA GRANATUM*[13]

Serial Number	Name	Language
1	Dadam	Gujarati
2	Dadima	Sanskrit
3	Anar	Hindi
4	Pomegranate	English
5	Madulai	Tamil
6	Daalimbe	Kannada
7	Madalam	Malayalam
8	Daalimb	Marathi

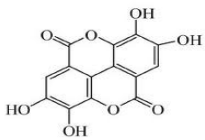
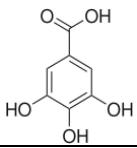
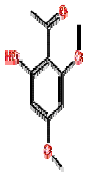
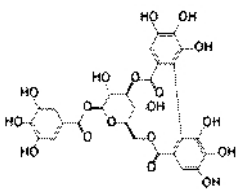
TABLE 2: NUTRITION VALUE OF *PUNICA GRANATUM* (PER 100 GM EDIBLE PORTION)[16]:

Compositions	Units	Quantity
Water	gm	80-82.3
Energy	kcal	63-78
Protein	gm	0.5-0.95
Fat	gm	0.3-09
Carbohydrates	gm	16.4
Fiber	gm	0.2-0.6
Ash	gm	0.5
Phosphorus	mg	8.0
Iron	mg	0.3
Potassium	mg	259
Calcium	mg	3.0
Sodium	mg	3.0
Manganese	mg	3.0
Zinc	mg	0.12
Magnesium	mg	0.15
Copper	mg	0.07
Selenium	mg	0.6
Panthothenic acid	mg	0.596
Vitamin B1	mg	0.03
Vitamin B2	mg	0.03
Vitamin B3	mg	0.03
Vitamin C	mg	4-6

TABLE 3: LIST THE PRINCIPLE CONSTITUENTS OF THE *PUNICA GRANATUM TREE AND FRUIT*[5]:

Plant components	Constituents
1. Pomegranate juice	Anthocyanins, glucose, ascorbic acid, ellagic acid, gallic acid, caffeic acid, catechin, quercetin, rutin and numerous minerals particularly iron, amino acids.
2. Pomegranate seed oil	95-percent punicic acid, other constituents, including ellagic acid other fatty acids, sterols.
3. Pomegranate pericarp (peel, rind)	Phenolic punicalagins; gallic acid and other fatty acids; catechin, quercetin, rutin, and other flavonols, flavones, flavonones, anthocyanidins.
4. Pomegranate leaves	Tannins (punicalin and punicafolin) and flavone glycosides including luteolin and apigenin.
5. Pomegranate flower	Gallic acid, ursolic acid, triterpenoids, including maslinic and asiatic acid other unidentified constituents.
6. Pomegranate roots and bark	Numerous piperidine alkaloids ellagitannins, including punicalin and punicalagin.

TABLE 4: PHYTOCONSTITUENTS OF *PUNICA GRANATUM*:

Chemical constituents	Chemical structures
Ellagic acid	
Gallic acid	
Brevifolin	
Corilagin	



1(a)



1(b)



1(c)



1(d)

Figure 1(a,b,c,d,) representing the Whole plant, Leaf, Flowers, fruit and Seeds of *Punica granatum*